

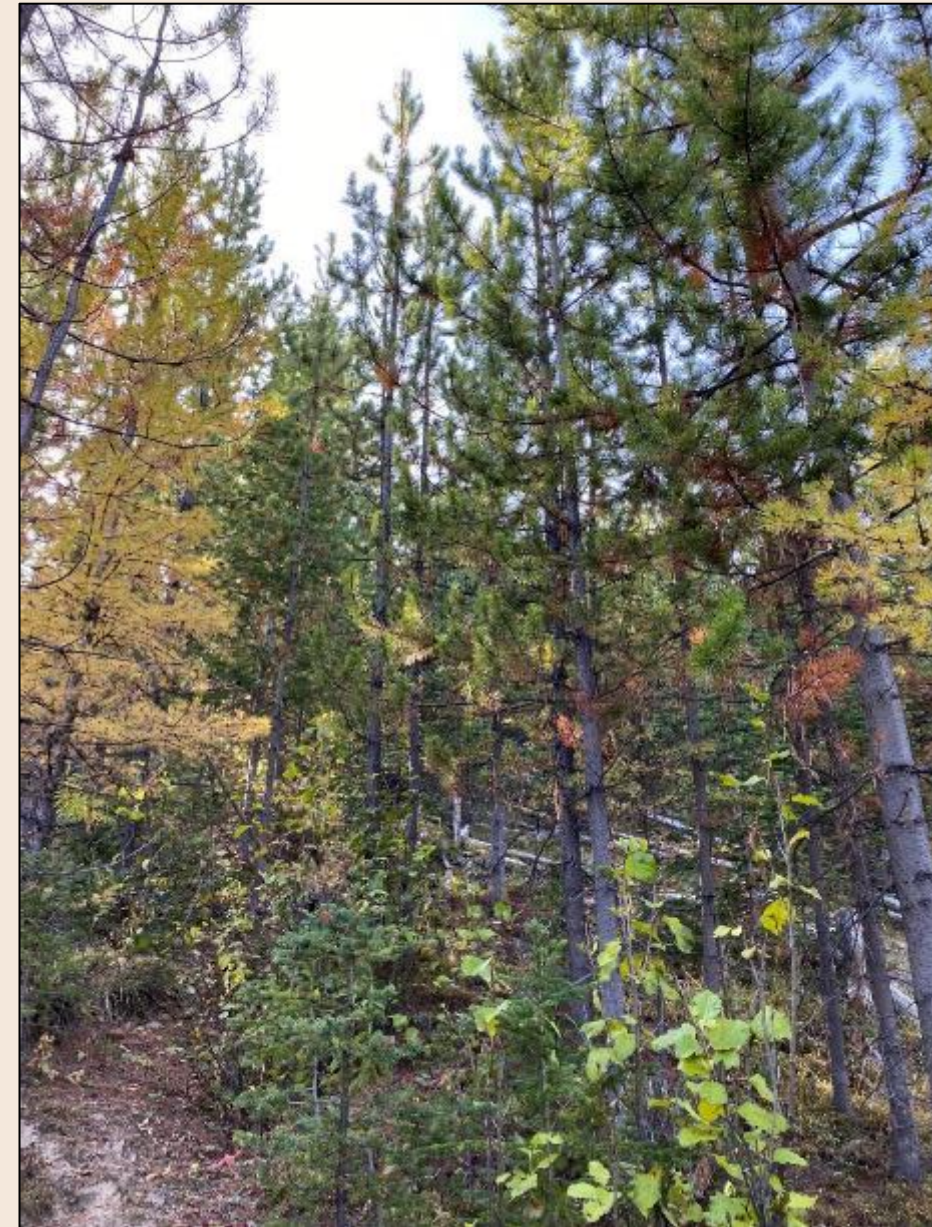


# Forest Resilience Metric in the Eastern Washington Sustainable Harvest Calculation

*A Presentation to the Board of Natural Resources*

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# Review of Staff Recommendations

- Future harvest and silviculture informed **by ecotypes shifts**. New strategy for explicitly incorporating climate change impacts in the model.
- Use a **forest resilience metric** to track forest health and resiliency over time. Could be used to drive harvest activities.
- **Forest health prioritization** framework could drive where forest health treatments should be conducted.





# Ecological Forest Resilience

The ability of a system to persist through and recover from disturbance

- Ability to adapt to a warming, drying climate and increases in wildfire by shifting to more drought and fire-tolerant tree species, fuel structures, and landscape patterns.
- Resistant to large-scale, high severity fires and drought-induced tree mortality that can lead to rapid destabilization



# Ecological Forest Resilience

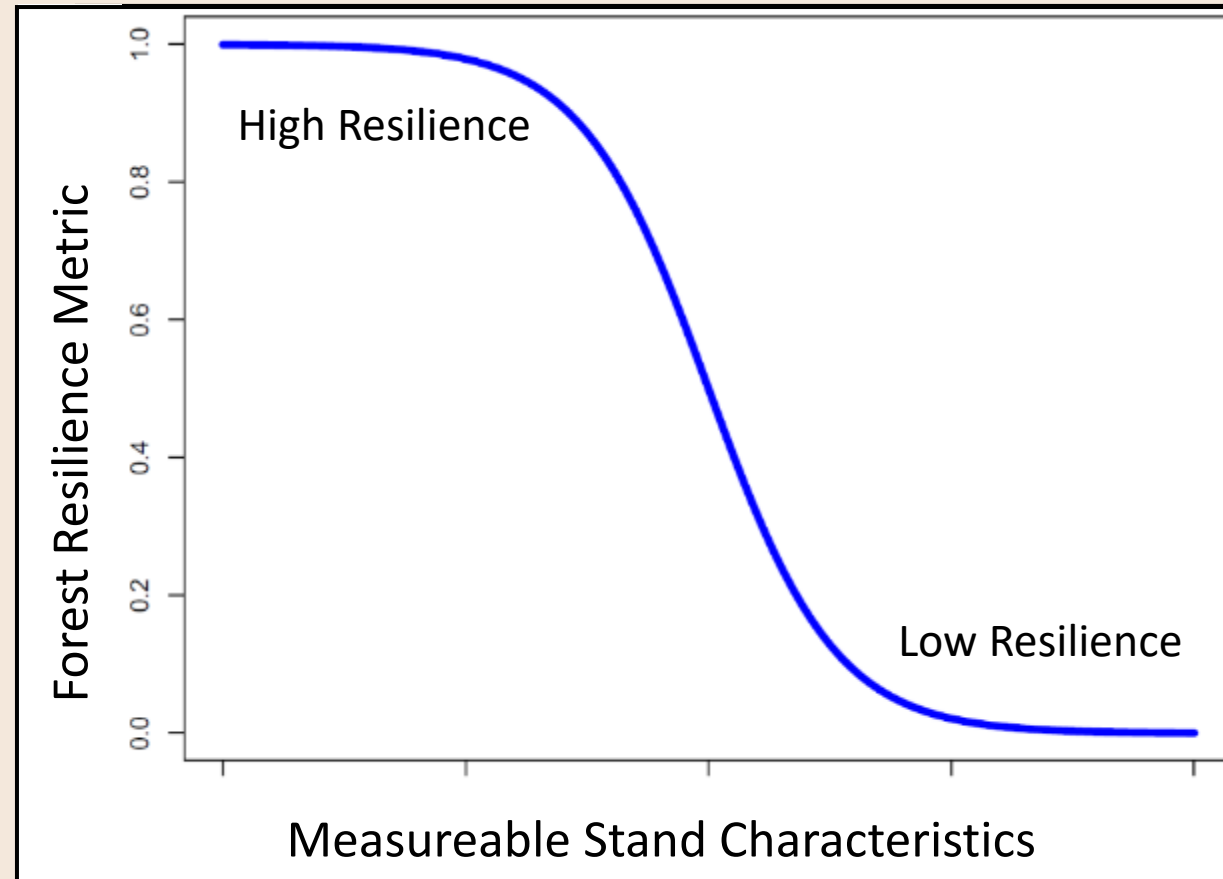


Forest health in RCW 76.06:

“The condition of a forest being sound in ecological function, sustainable, resilient, and resistant to insects, diseases, fire and other disturbances, and having the capacity to meet landowner objectives”



# Concept for Forest Resilience Metric



# Goals of a Forest Resilience Metric

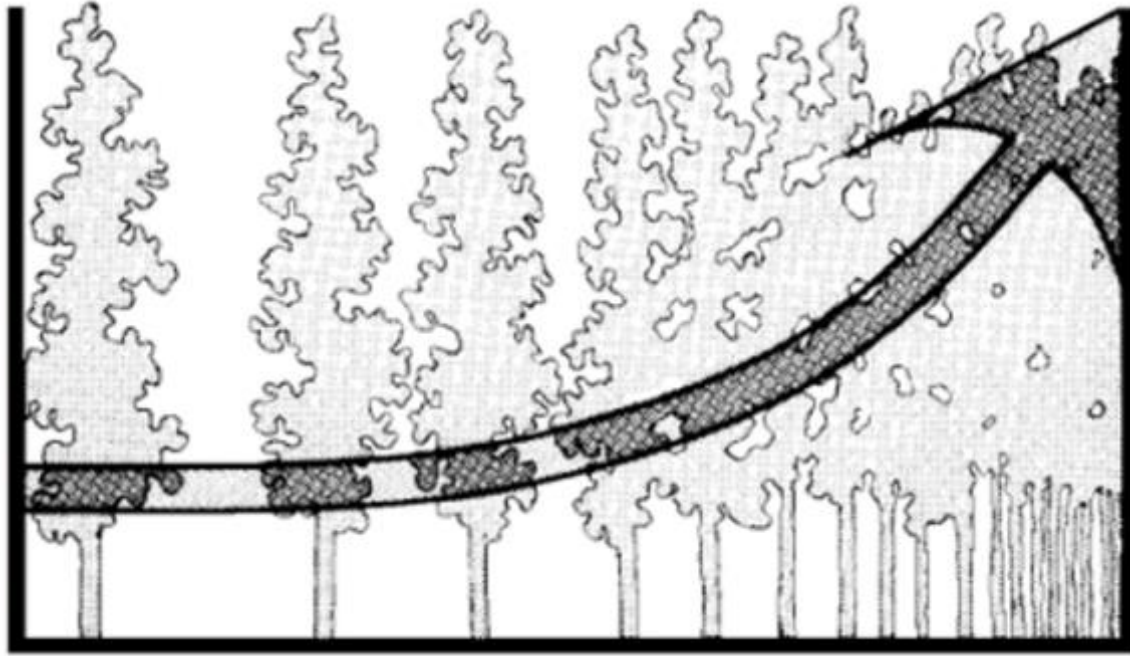
- Identify relevant components of forest resilience, especially those affected by management decisions
- Develop a single, quantitative stand-level forest resilience metric
- Track changes in forest resilience over time and under different management regimes



# Components of the Forest Resilience Metric

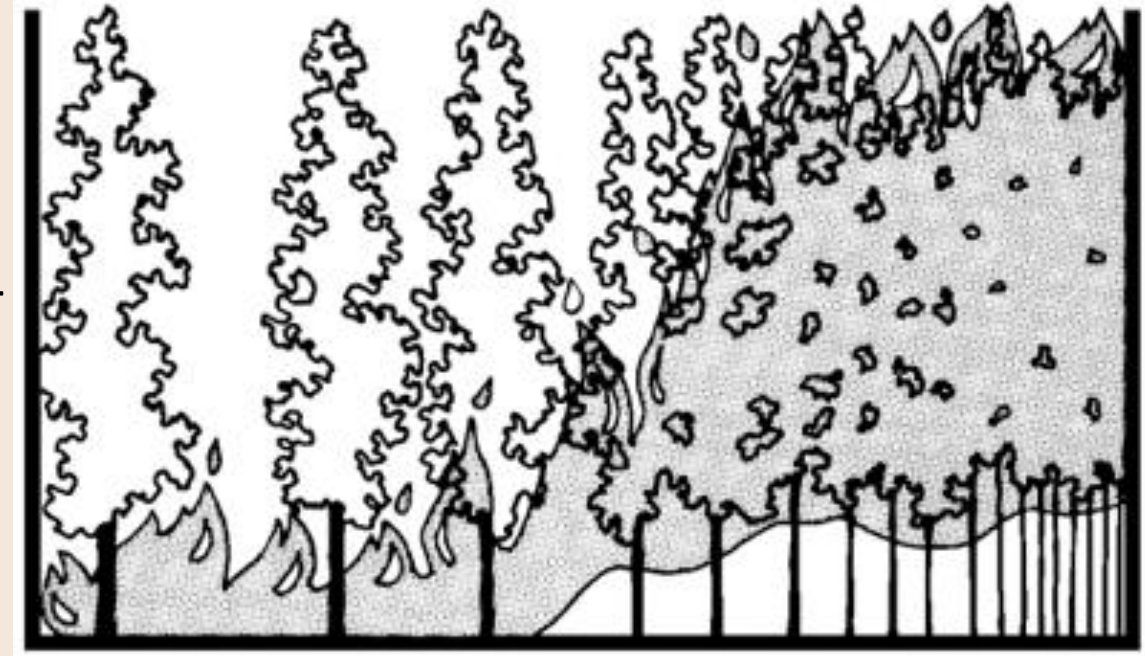
**As stand density increases the risk of insect, disease and fire impacts increases**

Insect and Disease Impacts



Stand Density

Fire Impacts



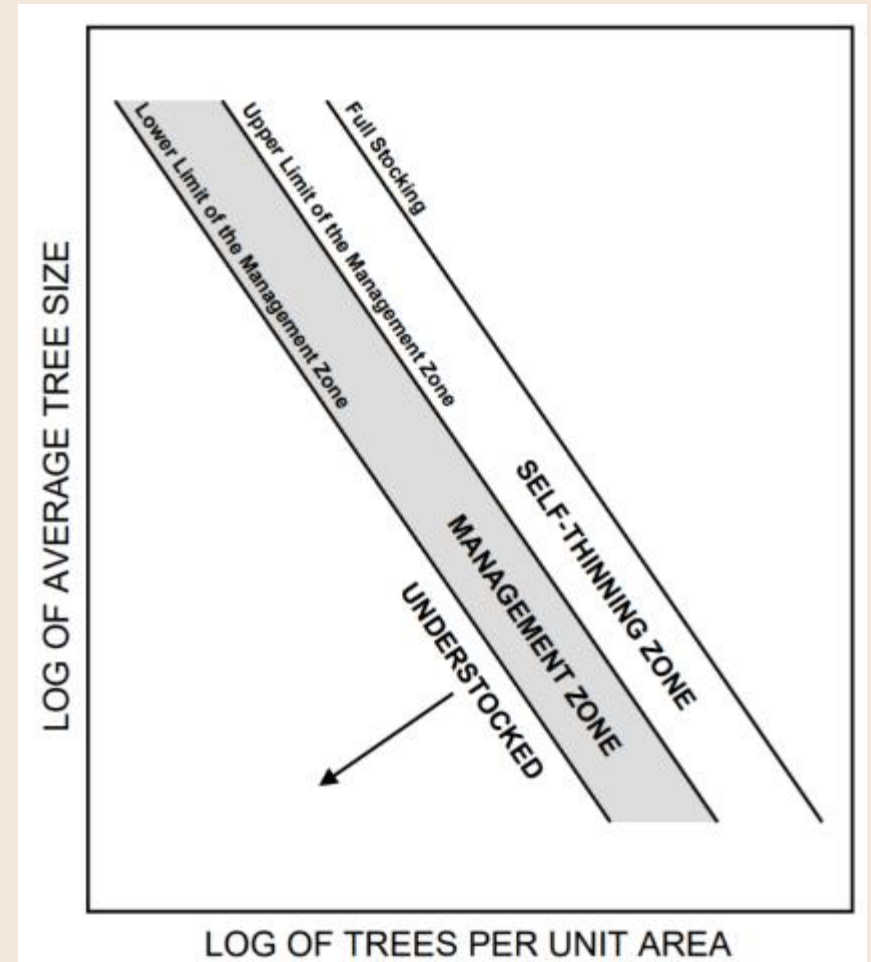
Stand Density

*Powell DC. 1999. Suggested Stocking Levels for Forest Stands in Northeastern Oregon and Southeastern Washington: An Implementation Guide for the Umatilla National Forest. USDA Forest Service Technical Publication F14-SO-TP-03-99.*



# Density Management for Resilience

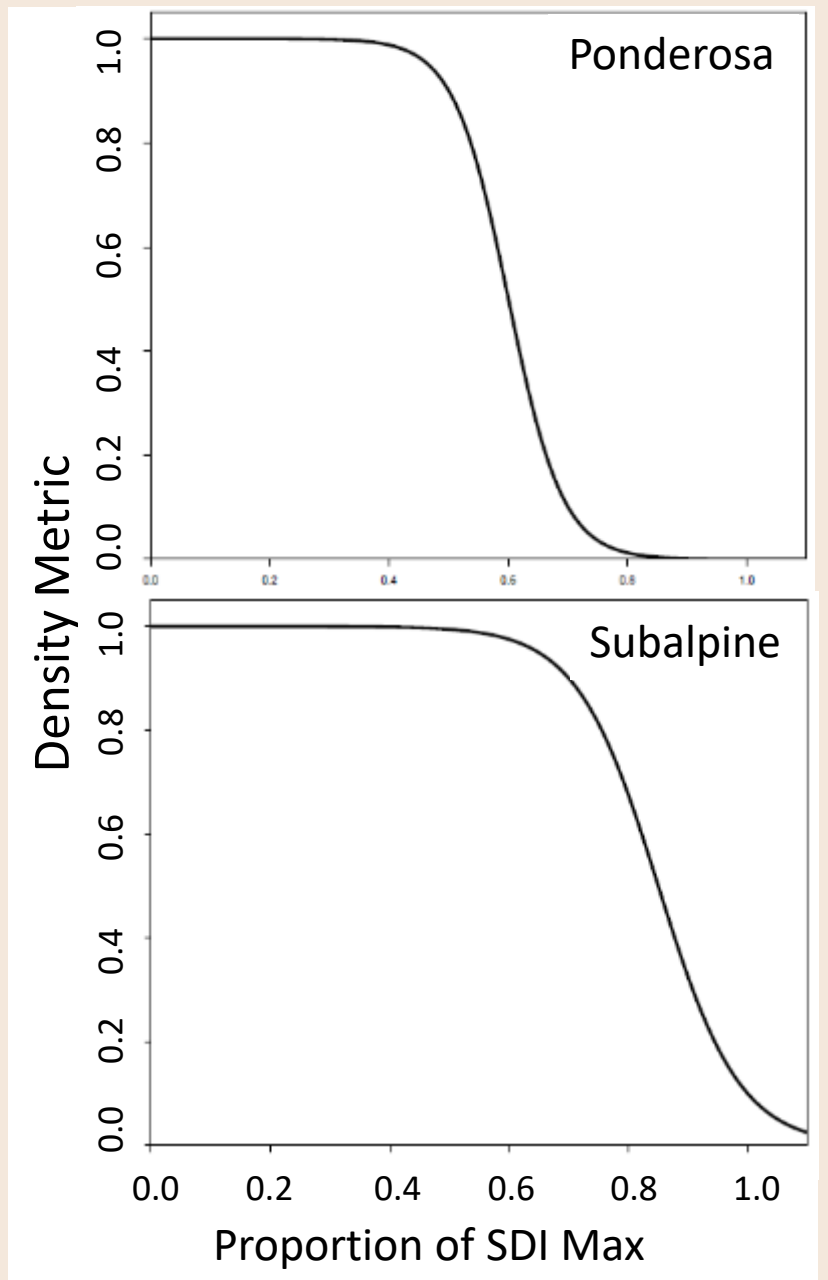
- Stand density index (SDI) is based on the relationship between tree size and the number of trees per acre
- Healthy forests generally fall within the 'management zone'
- As trees occupy more growing space, mortality occurs in the 'self-thinning zone'
- The full or maximum stocking is the SDI Max



*Powell DC. 1999. Suggested Stocking Levels for Forest Stands in Northeastern Oregon and Southeastern Washington: An Implementation Guide for the Umatilla National Forest. USDA Forest Service Technical Publication F14-SO-TP-03-99.*

# Density Metric

- Density metric quantifies the relationship between SDI and the maximum stocking or SDI Max
- SDI Max varies by vegetation ecotype
- The slope and shape of the curve varies by ecotype



# Insect and Disease Metric

- Determines a severity score of pathogen and insect infestation based on tree species and diameter size of individuals
- Determines likelihood score of impact by each pathogen and insect infestation by vegetation ecotype
- Scores generated through a collaborative effort between experts in DNR's Forest Resources and Forest Resiliency Divisions





# Insect and Disease: Individual-Tree Severity Scores

- List of potential threats generated for each tree species
- Severity of mortality is scored for each threat by diameter size class and tree species

Example Subset		Diameter size classes			Insect/Pathogen Name
Species		Small <10"	Medium 10"-20"	Large 20"+	
Douglas fir		1	3	3	Douglas fir beetle
Lodgepole Pine		3	5	5	Mountain pine beetle
Western redcedar		2	2	2	Armillaria root disease

Mortality Severity Score

1 = minor

2 = associated w/ other stressors

3 = moderate

4 = significant

5 = imminent

# Insect and Disease: Likelihood Scores by Vegetation Ecotype

- Likelihood of occurrence over a large scale, such as a watershed
- Threats from root disease and mistletoe are likely to be exacerbated by a changing climate

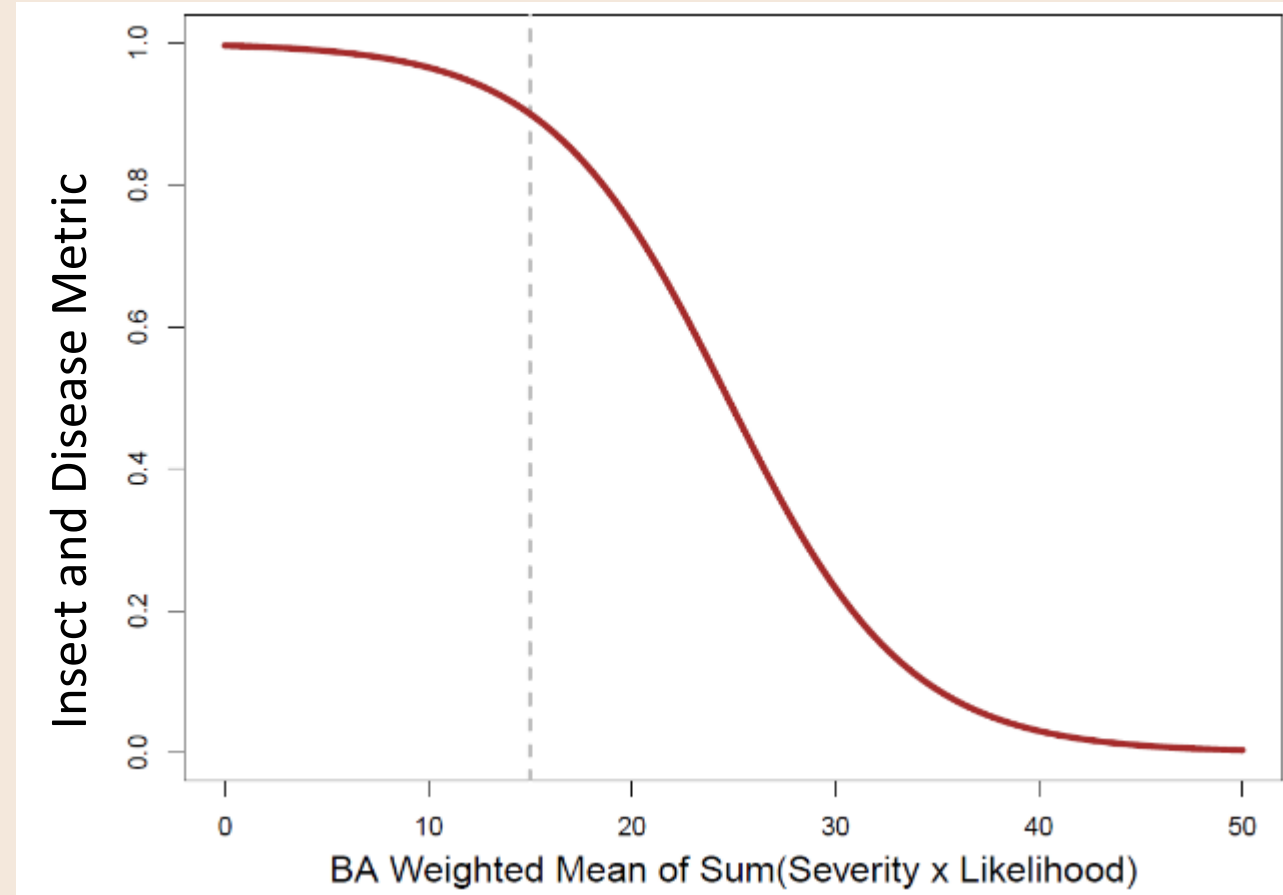
1 = rare occurrence  
 2 = likely to occur over a decade  
 3 = frequent/chronic

Example Subset		Diameter Size Class			Insect/Pathogen Name
Vegetation Ecotype	Species	Small <10"	Medium 10"-20"	Large 20"+	
All Ecotypes	Douglas-fir	1	2	2	Douglas fir beetle
Cool ecotypes	Lodgepole Pine	1	3	3	Mountain pine beetle
Warm and drier ecotypes	Lodgepole Pine	1	2	2	Mountain pine beetle
All Ecotypes	Western redcedar	3	3	3	Armillaria root disease



# Insect and Disease Metric

- Insect and Disease metric combines the severity and likelihood scores
- Scores are calculated from the yields
  - Changes reflected due to growth and changes in species composition post harvest





# Fire Metric

## Components

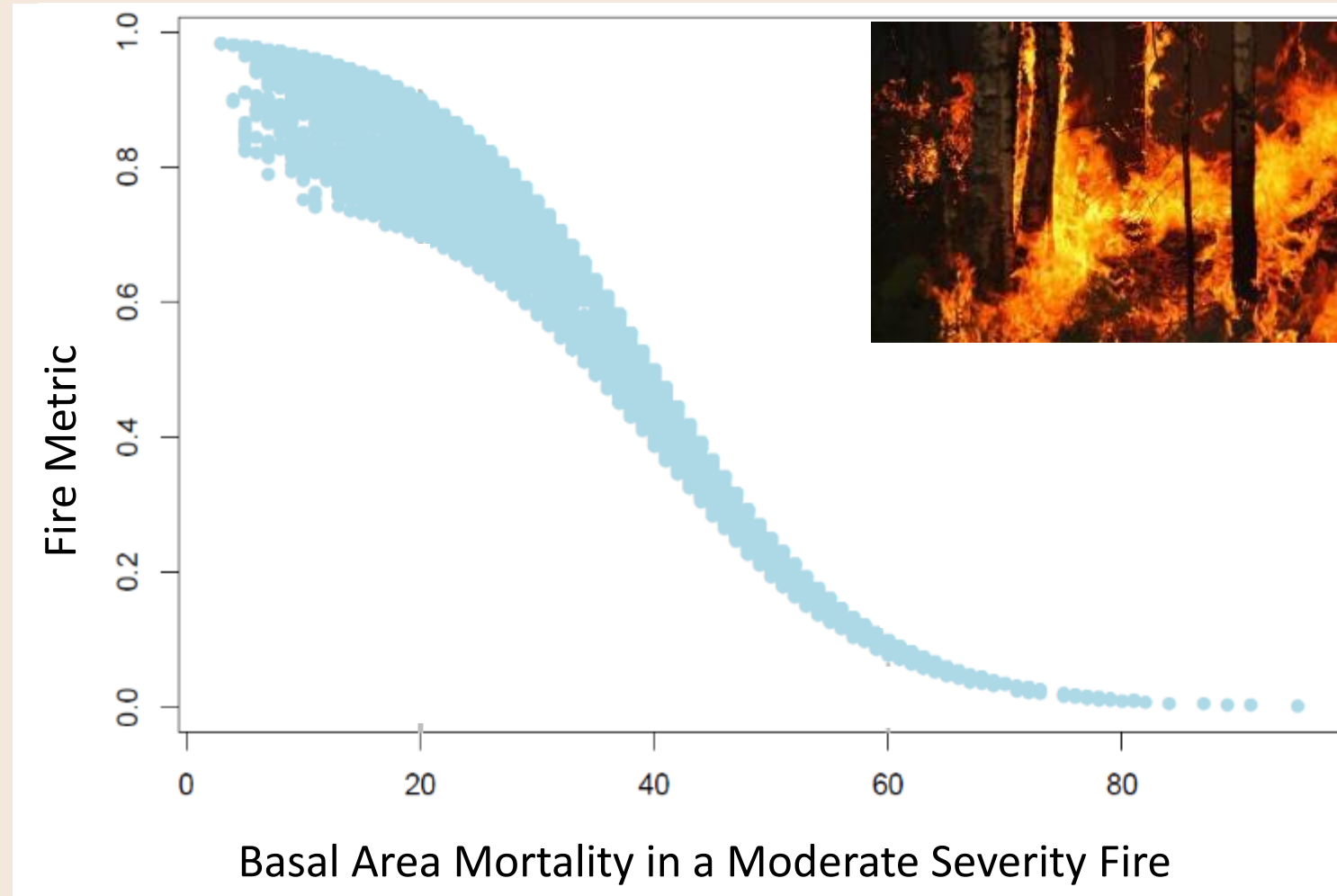
- Bark Thickness
- Species
- Diameter
- Total length of the crown in feet

USFS Forest Vegetation Simulator (FVS)

## Fire and Fuel Extension

- In a moderate severity fire, calculates the percent of the crown volume scorched and the mortality of basal area

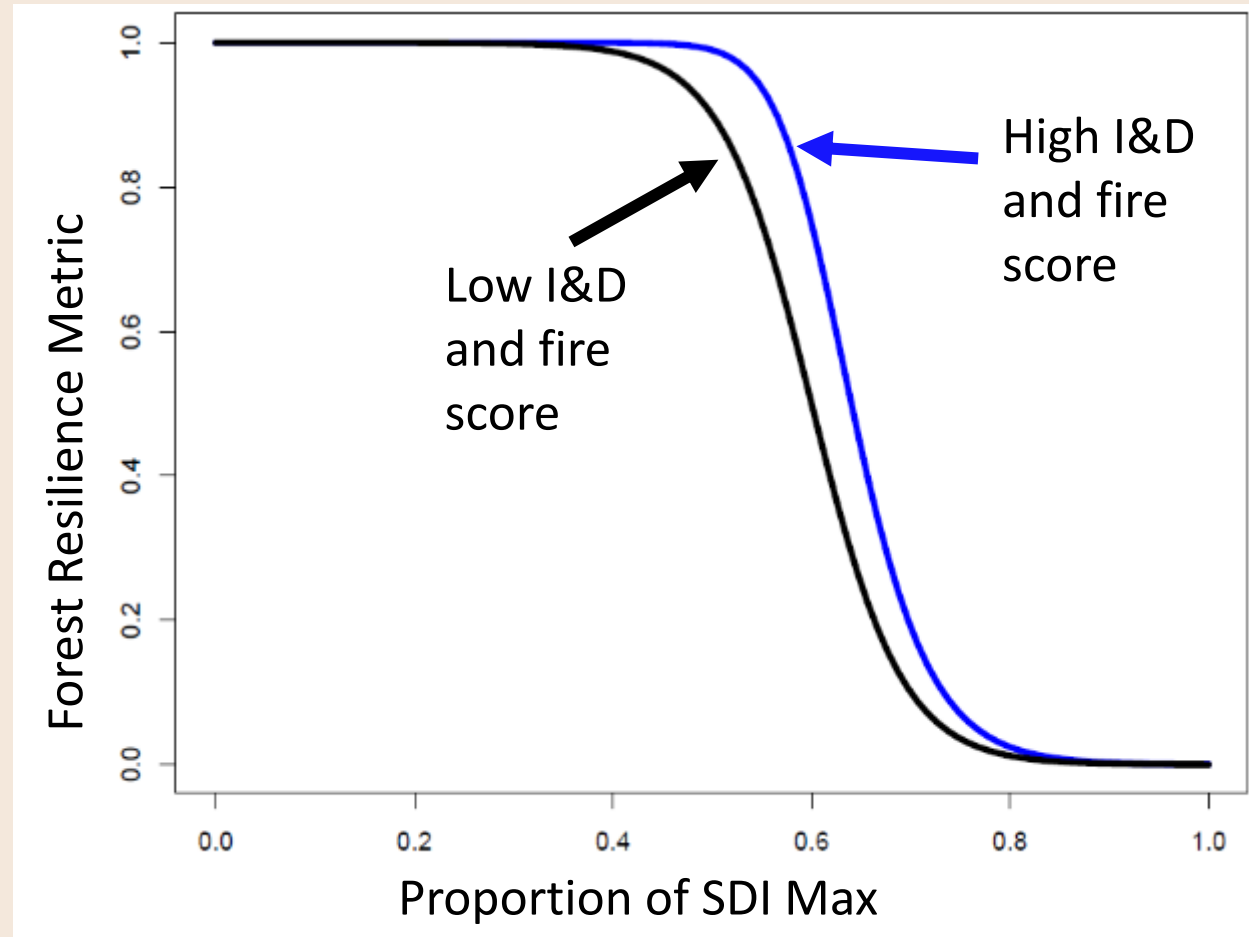
Fire metric has a high score if a modeled fire results in low mortality



# Integrating Metrics

## Forest Resilience Metric

- Density score is the primary component
- Threshold for resilience is extended to denser conditions if the insect and disease and fire scores are high (=good)



# Resilience Example

Low Resilience



High Resilience





# Resilience Example

High Resilience



Low Resilience

# Forest Resilience in the SHC

Forest resilience metric calculated from the yields

- Metric calculated for each decade modeled
  - FVS Treelists and FVS Fuel and Fire Extension outputs
- Tracked within stand-level and for stratified yield groupings

Use in the Forest Estate model for the SHC

- Summarized at various scales (vegetation ecotypes, SHUs, strata)
- Potential component of an action in the model
  - Proactive management vs reactive
- Future ecotypes impact future forest resilience scores (must explore iteratively)
- Integrate into policy direction

# Questions?





